



REC'D 22 MAR 2005

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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MRR 1565 PCT		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/03467	International filing date (day/month/year) 07.08.2003	Priority date (day/month/year) 23.08.2002	
International Patent Classification (IPC) or both national classification and IPC B01D15/00			
Applicant <div style="display: flex; justify-content: space-between;"> <span><del>JOHNSON-MATTHEY PUBLIC LIMITED COMPANY et al.</del></span> <span>ANGLO PLATINUM LIMITED</span> </div>			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>			
Date of submission of the demand  01.03.2004		Date of completion of this report  21.03.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  Hilgenga, K  Telephone No. +31 70 340-2072 	

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**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-21 as originally filed

**Claims, Numbers**

1-9 received on 25.11.2004 with letter of 22.11.2004

**Drawings, Sheets**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-9
	No: Claims	
Inventive step (IS)	Yes: Claims	2
	No: Claims	1,3-9
Industrial applicability (IA)	Yes: Claims	1-9
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following documents:

- D2: US-A-5 942 463 (S. OSCARSSON) 24 August 1999 (1999-08-24)
- D4: US-A-5 318 846 (BRUENING RONALD L ET AL) 7 June 1994 (1994-06-07)
- D5: E. ANTICO; A. MASANA: "Adsorption of palladium by glycolmethacrylate chelating resins" ANALYTICA CHIMICA ACTA, vol. 296, no. 3, 20 October 1994 (1994-10-20), pages 325-332, XP0008029679

1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT as explained in the following paragraphs 1.1 or 1.2.

1.1 Document D4 discloses a process for the separation of components (see column 1, lines 23-37 and column 10, line 59 to column 11, line 8) from a solution comprising HCl and palladium(Pd) (see column 10, lines 63-64) in admixture with other platinum group and/or base metals (see column 10, lines 64-65), the process comprising the steps of passing said solution over a hydrophilic medium which is a solid hydrophilic matrix, i.e. silica gel (see column 1, lines 6-7; column 6, lines 41-54 and column 10, line 60) comprising bound thioether ligands (see column 4, lines 36-39; column 3, lines 31-33; column 6, lines 42-68; column 7, lines 19-21) and separating the Pd from the other platinum group and/or base metals by retaining the Pd on the medium and eluting the other platinum group and/or base metals (see column 10, line 68 and column 11, line 6-8).

The subject-matter of claim 1 therefore differs from the process known in D4 in that a solid cross-linked organic polymer matrix is used instead of a silica gel.

When starting from document D4 as closest prior art, the problem to be solved by the present invention may therefore be regarded as providing a process for separating components from a solution comprising HCl and palladium(Pd) in admixture with other

platinum group and/or base metals which ensures a higher binding capacity for Pd (see page 1, line 29-30 and page 2, lines 28-29 of present application).

The solution proposed in claim 1 of the present application, i.e. the use of a solid cross-linked organic polymer matrix, cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

Document D5 discloses that silica bound chelating agents exhibit low capacity (see page 326, left column, line 9 and lines 20-22) in the adsorption of palladium and teaches instead the use of a cross-linked organic polymer as support matrix, i.e. a cross-linked hydroxyethylmethacrylate polymer (see page 326, left column, lines 31-33 and abstract) for ligands in the adsorption of palladium.

The solution to the problem mentioned here above would be obvious to the person skilled in the art as he would be prompted, namely when the same result is to be achieved, to use the cross-linked organic polymer matrix of document D5 in the separation process of document D4 in order to ensure a high binding capacity for palladium.

1.2 Document D5 discloses a process for the separation of components from a solution comprising HCl and palladium(Pd) (see abstract, lines 8-9 and line 4) in admixture with other platinum group and/or base metals (see page 325, abstract, line 8-9; page 332, lines 10-11), the process comprising the steps of passing said solution over a hydrophilic medium which is a solid hydrophilic medium comprising ligands, i.e. thiol groups or 8-hydroxyquinoline groups, bound to a cross-linked organic polymer matrix (see page 325, abstract, line 1; page 326, left column, lines 31-33; page 327, left column and page 329, right column, last paragraph) and separating the Pd from the other platinum group and/or base metals by retaining the Pd on the medium and eluting the other platinum group and/or base metals (see page 331, figure 7; page 332, left column, lines 20-24 and page 329, left column, lines 28-34).

The subject-matter of claim 1 therefore differs from the process known in D5 in that a thioether ligand is used as ligand.

When starting from document D5 alone as closest prior art, and in the absence of any effect shown by the use of thioether ligands in the process of present application with

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regard to the use of the ligands taught in D5, the problem to be solved by the present invention may be regarded as to provide an alternative process for the separation of components from a solution comprising HCl and palladium (Pd) in admixture with other platinum and/or base metals.

The solution to the problem mentioned here above would be obvious to the person skilled in the art as, in the absence of any shown technical effect, the thioether ligands are considered to be merely an obvious alternative to the ligands used in the process of D5.

2 Dependent claims 3, 4, 5, 6, 7, 8 and 9 do not contain any features which, in combination with the features of the claims to which they refer, meet the requirements of the PCT in respect of inventive step in the sense of Article 33(3) PCT for the following reasons:

Document D4 (see column 5, line 15) and D5 (see page 326, right column, line 30; page 325, abstract, line 5; page 329, left column, lines 31-33) teaches that retained palladium is recovered by elution with ammonia or a nitrogen-containing eluent, i.e. thiourea.

Document D4 discloses monothioether ligands (see column 6, line 50 and line 67) which are used in the separation process.

In document D4, the sulphur atom of the thioether group may be substituted by an alkyl group having from 1 to 6 carbon atoms (see column 3, lines 62-63).

Document D5 (see page 326, left column, line 32) discloses a cross-linked polymer comprising methacrylate moieties which is used as cross-linked organic polymer support matrix for the ligands and ligands which are bound to the polymer matrix through a combination of unbranched alkyl, ether and ester group (see page 327, left column, line 5), the alkyl group being substituted by hydroxyl.

D5 teaches that the medium used in a process of separation of palladium from a solution comprising HCl and palladium(Pd) in admixture with other base metals can be in the form of gels.

D2 discloses a medium for separating palladium which is a composite comprising a porous support, the pores containing the medium (see column 2, lines 43-52).

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As can be seen from the above, the features of dependent claims 3, 4, 5, 6, 7, 8 and 9 are known from documents D4, D5 or D2.

3 The feature of dependent claim 2 is neither known from, nor rendered obvious by, the available prior art. The reasons are as follows:

None of the prior art cited in the international search report teaches or suggests a process for the separation of components from a solution comprising HCl and palladium (Pd) in admixture with two or more other platinum group and/or base metals comprising the steps of passing said solution over a hydrophilic medium comprising thioether ligands bound to a solid cross-linked organic polymer matrix and separating the Pd from the two or more other platinum group and/or base metals by retaining the Pd on the medium whilst chromatographically separating the two or more other platinum group and/or base metals.

25. 11. 2004

CLAIMS

(59)

1. A process for the separation of components from a solution comprising HCl and palladium (Pd) in admixture with other platinum group and/or base metals, the process comprising the steps of passing said solution over a hydrophilic medium comprising thioether ligands bound to a solid cross-linked organic polymer matrix and separating the Pd from the other platinum group and/or base metals by retaining the Pd on the medium and eluting the other platinum group and/or base metals.
2. A process according to claim 1, wherein the solution comprises Pd in admixture with two or more other platinum group and/or base metals comprising chromatographically separating the two or more other platinum group and/or base metals.
3. A process according to claim 1 or 2, wherein the retained Pd is recovered by elution with ammonia or a nitrogen-containing eluant.
4. A process according to claim 1, 2 or 3, wherein the thioether ligands comprise monothioether ligands.
5. A process according to claim 1, 2, 3, or 4, wherein the polymer comprises methacrylate moieties, styrene moieties, poly(ethylene glycol) moieties or any combination or mixture thereof.
6. A process according to any preceding claim, wherein the ligands are bound to the polymer matrix through a branched or unbranched alkyl, aryl, aralkyl, ether or ester group or combination thereof, optionally substituted, especially by hydroxyl.
7. A process according to any preceding claim, wherein the sulphur atom of the thioether group is substituted by an alkyl group of 1 to 6 carbon atoms, optionally substituted, especially by hydroxyl.



8. A process according to any preceding claim, wherein the medium is in the form of a gel or a porous solid.

9. A process according to any preceding claim wherein the medium forms part of a composite chromatographic medium, the composite comprising a porous support, the pores of which contain the medium.